RESEARCH HIGHLIGHTS

Technical Series 00-109

SUMMARY REPORT FOR CONSORTIUM ON FIRE RESISTANCE AND SOUND INSULATION OF FLOORS: SOUND TRANSMISSION CLASS AND IMPACT INSULATION CLASS RESULTS

Introduction

Due to recent changes in code requirements for sound attenuation it was necessary to determine cost effective ways to achieve desired STC and IIC levels. A variety of materials, and floor assemblies needed to be compared to determine which combinations satisfied acoustic and cost considerations.

The project tested 190 specimens in a specially constructed chamber to provide the data needed to answer these questions. A separate report considers the effect sound attenuation measures may have on the fire resistance of floor assemblies.

This research report outlines the results of a series of tests on typical residential floor assemblies and materials that might be used to achieve desired sound insulation ratings. The report summarizes conclusions, which tend to support or refute common assumptions about typical materials, designs and construction practices.

The report focuses on two common rating formats for sound transmission: Sound Transmission Class (STC), and Impact Insulation Class (IIC). The results enable practitioners to make educated decisions when comparing options for floor assemblies in the field.

This research was undertaken by the IRC Acoustics Laboratory of the National Research Council and was supported by a consortium including: Boise Canada, Canada Mortgage and Housing Corporation (CMHC), Canadian Home Builders' Association (CHBA), Canadian Portland Cement Association (CPCA), Canadian Sheet Steel Building Institute (CSSBI), Canadian Wood Council (CWC), Cellulose Insulation Manufacturers Association of Canada (CIMAC), Forintek Canada Corporation (FORINTEK), Gypsum Association, Gypsum Manufacturers of Canada (GMC), Louisiana-Pacific Incorporated, Nascor Inc., Ontario New Home Warranty Program, Ontario Ministry of Housing, Owens Corning Fiberglass Canada Inc. (OCFCI), Roxul Inc. (ROXUL), Truss Joist MacMillan, and Willamette Industries.

Research Program

The assemblies were built using normal construction practices. A typical floor assembly was tested and rebuilt several times to act as a reference floor in order to gauge the repeatability and reproducibility value of the test protocol. Some experimental assemblies were also tested.

Sound transmission loss (TL) and sound transmission class (STC) were calculated according to ASTM E413, using loudspeakers.

Impact sound was measured in accordance with ASTM E492, and impact insulation class (IIC) was calculated according to ASTM E989, using a tapping machine.

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The report contains a diagram and test result chart for each series of tests on a floor assembly type. The thickness and type of floor joist, sub floor, gypsum, and insulation were varied to determine how the different configurations affected sound control. Other variables such as joist length, fastener spacing and tightness, and the use of adhesives and resilient channels were also tested.

For instance, assemblies using solid wood joists were compared with assemblies using composite I joists, wood trusses, and steel joists.

Variables tested include:

- solid wood and steel joists, composite I joists, and wood trusses, their depth and spacing
- glass fibre batts, mineral fibre batts, and sprayed on cellulose, in varying thicknesses and positions
- single and double layers of subflooring and gypsum ceilings
- resilient metal channels, resilient steel studs, U channels, wire supports, and wood furring
- wood floor assemblies with concrete topping
- uniform and rib slab concrete floors.

Findings

- Performance is most influenced by the sum of the masses per unit area of the floor and ceiling layers
- Performance can be improved by increasing the thickness and density of the insulation
- Results for wood I joists showed significant variation, while trusses showed low IIC results
- There was no difference between floors using cross bracing or strapping
- Floors with concrete toppings and without resilient channels have poor IIC ratings.

Good practice that improves sound control may reduce fire control, and good practice that improves fire control may not improve sound control. For instance, for better fire resistance in single layer gypsum ceilings, the gypsum board can be suspended with additional channel at butt edges, however this practice can lower STC and IIC ratings by 2 dB. Two layer gypsum board ceilings are not significantly affected by the same practice.

Several key findings are of interest to the building industry:

- several common methods or beliefs were found not to be effective:
  - results were not affected by increasing the number or tightness of screws or nails, or by the use of adhesives
  - the location of the insulation within the joist cavity does not matter
  - placing resilient channels between two layers of drywall gave poor performance
- some techniques are essential to achieve rated floor assemblies:
  - joist floors require resilient metal channels to achieve STC 50, with or without insulation
- some desirable techniques may reduce costs:
  - performance can be improved by increasing the depth and spacing of the joists, and by increasing the spacing of the resilient channels
  - adding resilient surface layers over concrete toppings greatly improves IIC ratings.

Implications for the Housing Industry

There are many ways to build a floor assembly to meet acoustic targets, using common building materials. Some common field practices are not effective.

Cost effective floor assemblies require resilient channels to achieve STC 50 ratings.

Adding more insulation, or denser insulation improves acoustic performance, however it is not significant without resilient channels.

Increasing the depth and spacing of the joists and the spacing of the resilient channels improves acoustic performance.

Adding resilient channels to floors with concrete surfaces significantly improves IIC ratings.

Resilient channel between two layers of drywall is not effective.

Using resilient channel to support butt ends of single layer gypsum boards reduces acoustic performance.

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Adding resilient surfaces to concrete toppings significantly improves IIC ratings.

Additional Research Needs

More research is needed:

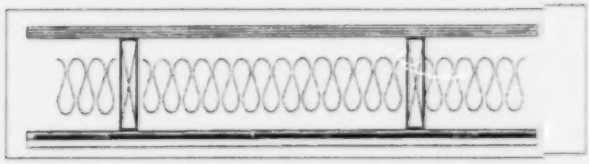
- to determine why some common building materials such as trusses and I joists produced unpredictable variations
- to determine the measurable improvement related to using higher density insulation
- to determine the impact of dense packing insulation
- to improve the accuracy of prediction models.

A separate project is exploring the influence of floor toppings on impact sound insulation.

Table 1 Solid Wood Joists—Single layer subfloors and one or two ceiling layers

Joist Depth	235 mm
Joist Spacing	406 mm o.c.
Cavity filling	152 mm glass fiber batts
Resilient channels	610 mm o.c.

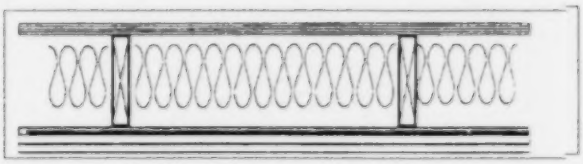
(a) Single layer subfloor and ceiling



Subfloor material	Subfloor thickness, mm	Gypsum board thickness, mm	Test ID	STC	Test ID	IIC
OSB	15	12.7[1]	TLF-95-155a	49	IIF-95-059	43
OSB	15	12.7	TLF-95-113a	51	IIF-95-040	45
OSB	15	15.9	Mean Ref	52	Mean Ref	46
OSB	19	15.9	TLF-95-127a	52	IIF-95-045	46
Plywood	15	15.9	TLF-95-133a	50	IIF-95-048	43
Plywood	25	15.9	TLF-96-061a	52	IIF-96-018	44

[1] 7.4 kg/m^2 (1.5 lb/sq.ft)

(b) Single layer subfloor and double layer ceiling



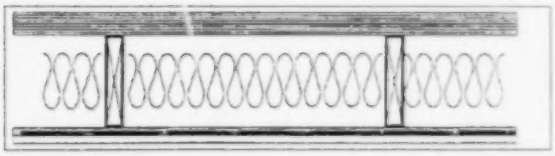
Subfloor material	Subfloor thickness, mm	Gypsum board thickness, mm	Test ID	STC	Test ID	IIC
OSB	15	2*12.7[1]	TLF-95-157a	54	IIF-95-060	48
OSB	15	2*12.7	TLF-95-115a	56	IIF-95-041	50
OSB	15	2*15.9	TLF-95-107a	55	IIF-95-039	49
Plywood	15	2*15.9	TLF-95-145a	55	IIF-95-054	49
Plywood	25	2*15.9	TLF-96-065a	56	IIF-96-020	48

[1] 7.4 kg/m^2 (1.5 lb/sq.ft)

Table 2 Solid Wood Joists—Double layer subfloors and one or two ceiling layers

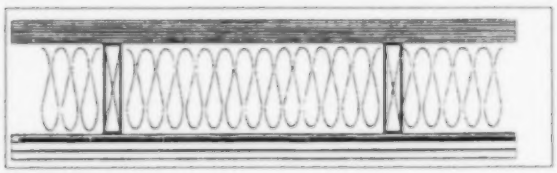
Joist Depth	235 mm
Joist Spacing	406 mm o.c.
Cavity filling	152 mm glass fiber batts
Resilient channels	610 mm o.c.

(c) Double layer subfloor and single layer ceiling



Subfloor material	Subfloor thickness, mm	Gypsum board thickness, mm	Test ID	STC	Test ID	IIC
OSB	2*15	15.9	TLF-95-123a	55	IIF-95-043	47
Plywood	2*13	15.9	TLF-95-129a	51	IIF-95-046	46
Plywood	2*15	15.9	TLF-95-149a	53	IIF-95-056	46

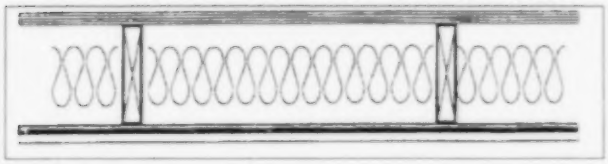
(d) Double layer subfloor and double layer ceiling



Subfloor material	Subfloor thickness, mm	Gypsum board thickness, mm	Test ID	STC	Test ID	IIC
Plywood	2*13	2*15.9	TLF-95-131a	58	IIF-95-047	53
Plywood	2*15	2*15.9	TLF-95-147a	58	IIF-95-055	51
OSB	2*15	2*15.9	TLF-95-125a	60	IIF-95-044	53

Table 3 Solid Wood Joists—Varying depth and spacing of joists

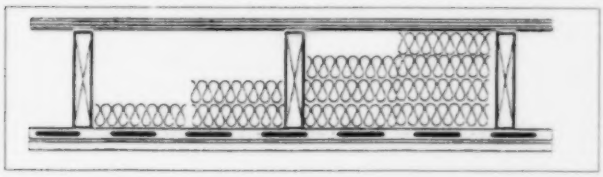
Subfloor	15 & 19 mm OSB
Cavity filling	152 mm glass fiber batts
Resilient metal channels	610 mm o.c.
Ceiling	1 layer 15.9 mm gypsum board



Joist Depth, mm	Joist Spacing, mm	OSB thickness, mm	Test ID	STC	Test ID	IIC
184	406	15	TLF-95-159a	50	IIF-95-061	44
235	300	15	TLF-96-031a	50	IIF-96-007	44
235	406	15	Mean Ref	52	Mean Ref	46
235	500	15	TLF-96-043a	52	IIF-96-013	46
235	610	15	TLF-96-035a	54	IIF-96-009	46
235	610	19	TLF-96-039a	53	IIF-96-011	46
286	406	15	TLF-95-215a	52	IIF-95-075	46

Table 4 Solid Wood Joists—Variable cavity fillings

Joist Depth	235 mm
Joist Spacing	406 mm o.c.
Subfloor	15 mm OSB
Resilient metal channels	610 mm o.c.
Ceiling gypsum board	1 layer 15.9 mm

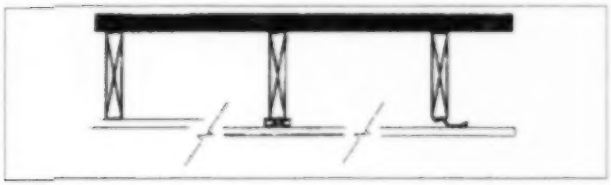


Cavity Filling					
Type[1]	**Thickness**	**Test ID**	**STC**	**Test ID**	**IIC**
None	Empty	TLF-96-063a	43	IIF-96-019	37
GFB	65	TLF-95-063a	50	IIF-95-019	45
GFB	90	TLF-95-085a	51	IIF-95-030	45
GFB	152	Mean ref	52	Mean ref	46
GFB	202	TLF-95-089a	53	IIF-95-032	46
GFB	217	TLF-95-061a	53	IIF-95-018	46
GFB	270	TLF-96-059a	53	IIF-96-017	46
RFB	90	TLF-95-065a	51	IIF-95-020	46
RFB	210	TLF-95-067a	54	IIF-95-021	48
CFS	59	TLF-95-143a	49	IIF-95-053	42
CFS	90	TLF-96-033a	52	IIF-96-008	45

[1] GFB=glass fiber batts, RFB=rock fiber batts, CFS=sprayed on cellulose fiber.

Table 5 Solid Wood Joists—Variable ceiling supports, empty cavity

Joist Depth	235 mm
Joist Spacing	406 mm o.c.
Subfloor	15 mm OSB
Cavity filling	None
Ceiling gypsum board	1 layer 15.9 mm

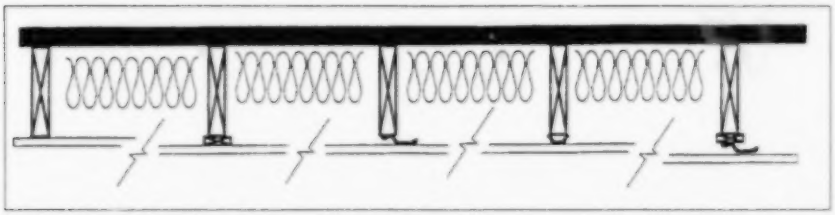


Furring type[1]	Test ID	STC	Test ID	IIC
None	TLF-95-095a	33	IIF-95-035	28
RC 610 mm o.c.	TLF-96-063a	43	IIF-96-019	37
WF 610 mm o.c.	TLF-95-097a	39	IIF-95-036	32

[1] RC=13 mm resilient metal channels, WF=19 x 64 mm wood furring

Table 6 Solid Wood Joists—Variable ceiling supports, absorption in cavity

Joist Depth	235 mm
Joist Spacing	406 mm o.c.
Subfloor	15 mm OSB
Cavity filling	152 mm glass fiber batts
Ceiling gypsum board	1 layer 15.9 mm

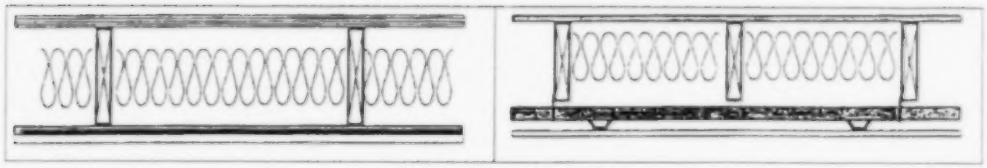


Furring type[1]	Test ID	STC	Test ID	IIC
none	TLF-95-073a	34	IIF-95-024	30
RC 200 mm o.c.	TLF-95-077a	47	IIF-95-026	40
RC 300 mm o.c.	TLF-95-079a	49	IIF-95-027	42
RC 406 mm o.c.	TLF-95-075a	50	IIF-95-025	42
RC 610 mm o.c.	Mean ref	52	Mean ref	46
UC 610 mm o.c.	TLF-95-081a	43	IIF-95-028	36
WF 610 mm o.c.	TLF-95-083a	42	IIF-95-029	35
WF 610 mm o.c. and RC 610 mm o.c.	TLF-95-087a	52	IIF-95-031	45
WF 610 mm o.c. and RC 610 mm o.c., no cross-bracing	TLF-95-091a	52	IIF-95-033	45

[1] RC=13 mm resilient metal channels, UC=22 mm deep U-channels, WF=19 x 64 mm wood furring

Table 7 Solid Wood Joists—Alternative ceiling support

Joist Spacing	406 mm o.c.
Subfloor	15 mm OSB
Cavity filling	152 mm glass fiber batts
Ceiling gypsum board	1 layer 15.9 mm

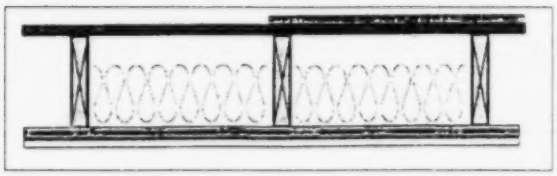


Note: The cavity depth is approximately the same in these two cases.

Joist depth, mm	Ceiling support	Test ID	STC	Test ID	IIC
286	Resilient metal channels, 610 mm o.c.	TLF-95-215a	52	IIF-95-075	46
235	Wire, C- and U-channels	TLF-96-089a	54	IIF-96-038	49

Table 8 Solid Wood Joists—Different floor coverings

Joist Depth	235 mm
Joist Spacing	406 mm o.c.
Subfloor	15 mm OSB
Cavity filling	152 mm glass fiber batts
Resilient Metal Channels	610 mm o.c.
Ceiling gypsum board	1 layer 15.9 mm

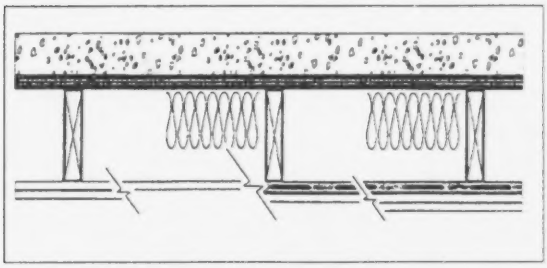


Covering	Test ID	STC	Test ID	IIC
None	Mean Ref	52	Mean Ref	46
Carpet and 9 mm foam underpad	TLF-96-057a	53	IIF-96-016	67
1.2 mm vinyl, inexpensive	No Test		IIF-96-029	44
1.9 mm vinyl, expensive	No Test		IIF-96-030	45
1.2 mm vinyl, medium priced	No Test		IIF-96-031	45

Note that the vinyl layers were glued to the floor but tests with the vinyl stapled to the floor give the same IIC ratings although there were significant differences between the two methods of installation at frequencies around 2500 Hz.

Table 9 Solid Wood Joists—35 mm thick concrete topping with varying ceilings and cavity fillings

Joist Depth	235 mm
Joist Spacing	406 mm o.c.
Subfloor	15 mm OSB
Cavity filling	152 mm glass fiber batts



(a) Pre-poured, reinforced 35 mm concrete slab placed on top of OSB

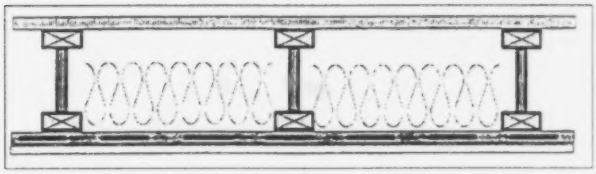
Gypsum Board Thickness, mm	Resilient Channels	Cavity Filling	Test ID	STC	Test ID	IIC
15.9	None	152 mm glass fiber batts	TLF-96-111a	48	IIF-96-049	35
15.9	610 mm o.c.	152 mm glass fiber batts	TLF-96-107a	68	IIF-96-047	48

(b) 35 mm concrete poured directly on the the OSB sub-floor and allowed to set

Gypsum Board Thickness, mm	Resilient Channels	Cavity Filling	Test ID	STC	Test ID	IIC
15.9	None	152 mm glass fiber batts	TLF-96-139a	48	IIF-96-061	28
15.9	610 mm o.c.	152 mm glass fiber batts	TLF-96-143a	67	IIF-96-063	40
2*15.9	610 mm o.c.	152 mm glass fiber batts	TLF-96-147a	70	IIF-96-065	46
15.9	610 mm o.c.	None	TLF-96-151a	61	IIF-96-067	32
2*15.9	610 mm o.c.	None	TLF-96-155a	65	IIF-96-068	38
15.9	None	None	TLF-96-157a	46	IIF-96-069	25
2*15.9	None	None	TLF-96-161a	47	IIF-96-071	30

Table 10 Wood I-Joists—Different manufacturers

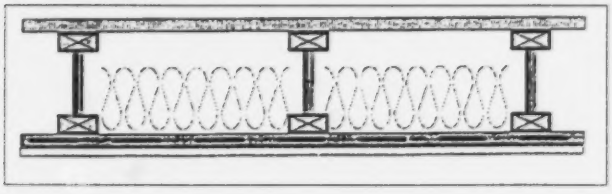
Joist Depth	241 mm
Joist Spacing	406 mm o.c.
Subfloor	15 mm OSB
Cavity filling	152 mm glass fiber batts
Resilient metal channels	610 mm o.c.
Ceiling gypsum board	1 layer 15.9 mm



	Flange dimensions, mm					
Manufacturer	**Horizontal**	**Vertical**	**Test ID**	**STC**	**Test ID**	**IIC**
A	64	38	TLF-96-069a	51	IIF-96-022	45
A	38	64	TLF-96-071a	51	IIF-96-023	46
A	89	38	TLF-96-073a	52	IIF-96-024	45
B	38	38	TLF-96-127a	52	IIF-96-055	45
B	57	38	TLF-96-131a	53	IIF-96-057	46
C	38	38	TLF-96-159a	50	IIF-96-070	44
D	38	38	TLF-97-007a	48	IIF-97-004	42
E	64	38	TLF-97-029a	48	IIF-97-015	42

Table 11 Wood I-Joists—89 wide x 38 mm thick flanges, different joist depths

Joist Spacing	406 mm o.c.
Subfloor	15 mm OSB
Cavity filling	152 mm glass fiber batts
Resilient metal channels	610 mm o.c.
Ceiling gypsum board	1 layer 15.9 mm

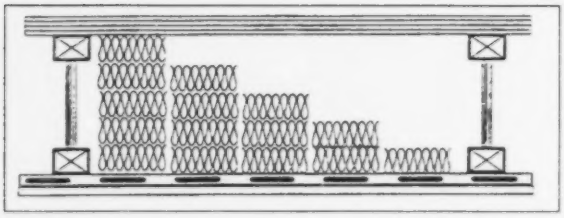


Joist Depth, mm	Test ID	STC	Test ID	IIC
241	TLF-96-073a	52	IIF-96-024	45
355	TLF-96-075a	53	IIF-96-028	45
457[1]	TLF-96-077a	53	IIF-96-032	46
457	TLF-96-101a	53	IIF-96-044	47

[1] 15 mm Waferboard, not OSB

Table 12 Wood I-Joists—Variable cavity filling

Joist Depth	457 mm
Joist Spacing	406 mm o.c.
Subfloor	15 mm OSB
Resilient metal channels	610 mm o.c.
Ceiling gypsum board	1 layer 15.9 mm

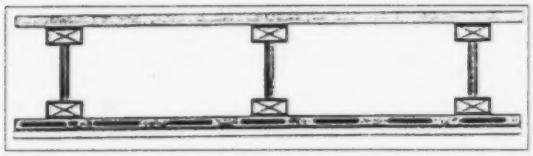


Material[1]	Thickness	Test ID	STC	Test ID	IIC
GFB	90	TLF-96-105a	52	IIF-96-046	46
GFB	152	TLF-96-101a	53	IIF-96-044	47
GFB	180	TLF-96-109a	54	IIF-96-048	47
GFB	292	TLF-96-113a	55	IIF-96-050	48
GFB	354	TLF-96-115a	56	IIF-96-051	49
GFB	456	TLF-96-117a	57	IIF-96-052	49
RFB	90	TLF-96-119a	53	IIF-96-053	47
RFB	456	TLF-96-121a	59	IIF-96-054	51

[1] GFB=glass fiber batts, RFB=rock fiber batts.

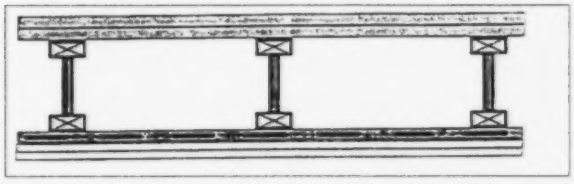
Table 13 241 mm deep Wood I-Joists, 89 wide x 38 mm high flanges, empty cavity—Variable joist spacing, subfloors, ceilings and resilient metal channel spacings

(a) Single layer of 15 mm OSB, single layer of 12.7 mm gypsum board



I-joist spacing, mm	Resilient channel spacing, mm	Test ID	STC	Test ID	IIC
406	610	TLF-96-165a	43	IIF-96-073	36
406	406	TLF-96-193a	42	IIF-96-085	36
610 (10 joists)	406	TLF-96-201a	44	IIF-96-089	35

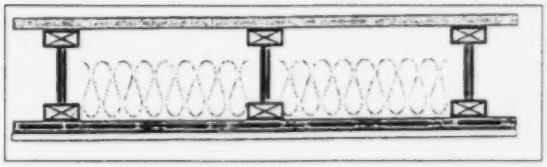
(b) Double layer of 15 mm OSB, double layer of gypsum board



double layer of 12.7 mm gypsum board					
406	406	TLF-96-187a	51	IIF-96-082	43
406	610	TLF-96-177a	51	IIF-96-079	41
610 (10 joists)	406	TLF-97-001a	53	IIF-97-001	44
double layer of 15.9 mm gypsum board					
406	406	TLF-96-197a	49	IIF-96-087	41
406	610	TLF-96-181a	51	IIF-96-081	45
610 (10 joists)	406	TLF-97-005a	53	IIF-97-003	45

Table 14 Wood I-Joists—Different resilient metal channel (RC) spacing

Joist Depth	241 mm
Joist Spacing	406 mm o.c.
Subfloor	15 mm OSB
Cavity filling	152 mm glass fiber batts
Ceiling gypsum board	1 layer 15.9 mm

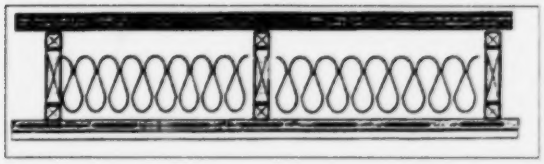


Resilient channel spacing	Test ID	STC	Test ID	IIC
406 mm	TLF-97-003a	50	IIF-97-002	44
610 mm	TLF-97-007a	48	IIF-97-004	42

Table 15 Wood Truss Floors—Varying joist depth and spacing and varying subfloor

Cavity filling	152 mm glass fiber batts
Resilient metal channels	610 mm o.c.
Ceiling gypsum board	1 layer 15.9 mm

Trusses constructed from 38 x 89 mm lumber with largest dimension vertical

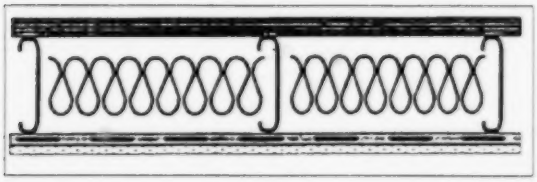


OSB thickness	Truss depth	Truss spacing	Test ID	STC	Test ID	IIC
15	356	406	TLF-97-033a	54	IIF-97-017	412
15	356	488	TLF-97-039a	52	IIF-97-019	411
15	356	610	TLF-97-045a	54	IIF-97-022	412
15	457	488	TLF-97-041a	55	IIF-97-020	414
15	457	610	TLF-97-043a	53	IIF-97-021	412
19	356	610	TLF-97-047a	54	IIF-97-023	412
19	356[1]	610	TLF-97-053a	55	IIF-97-026	413
19	457	610	TLF-97-049a	53	IIF-97-024	412
19	610	610	TLF-97-051a	55	IIF-97-025	413

[1] Truss formed from 38 x 64 mm lumber with largest dimension horizontal

Table 16 Steel Joist Floors—Varying joist depth, spacing and metal gauge, varying subfloor

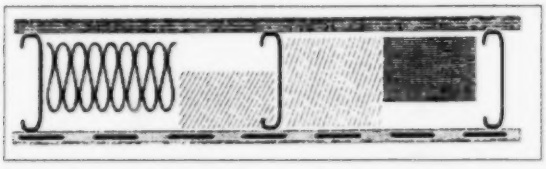
Cavity filling	152 mm glass fiber batts
Resilient Metal Channels	610 mm o.c.
Ceiling gypsum board	1 layer 15.9 mm



Steel Gauge	Joist Depth	Joist Spacing	OSB Thickness	Test ID	STC	Test ID	IIC
14	203	406	16 mm OSB	TLF-97-057a	52	IIF-97-028	45
16	203	406	16 mm OSB	TLF-97-059a	51	IIF-97-029	45
18	203	406	16 mm OSB	TLF-97-061a	50	IIF-97-030	44
16	203	610	16 mm OSB	TLF-97-063a	53	IIF-97-031	44
16	254	406	16 mm OSB	TLF-97-065a	51	IIF-97-032	44
16	305	406	16 mm OSB	TLF-97-069a	52	IIF-97-034	44
16	203	610	19 mm OSB	TLF-97-067a	53	IIF-97-033	44

Table 17 Steel Joists, 16 gauge—Varying cavity absorption

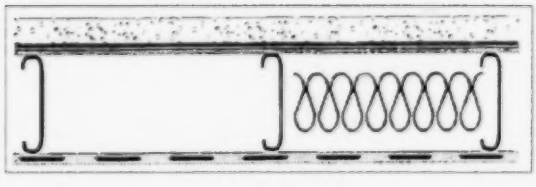
Subfloor	15 mm OSB
Joist Depth	203 mm
Joist Spacing	406 mm
Resilient Metal Channels	610 mm o.c.
Ceiling gypsum board	1 layer 15.9 mm



Cavity filling	Test ID	STC	Test ID	IIC
none	TLF-98-009a	44	IIF-98-004	35
152 mm glass fiber batts	TLF-98-001a	50	IIF-98-001	43
140 mm rock fiber batts	TLF-98-005a	51	IIF-98-002	45
90 mm Cellulose fiber	TLF-98-011a	51	IIF-98-005	44
140 mm Cellulose fiber	TLF-98-013a	52	IIF-98-006	45

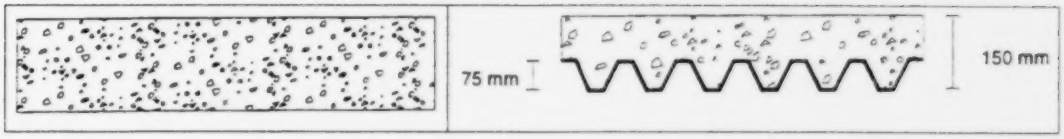
Table 18 Steel Joists, 16 gauge—Gypsum concrete topping

25 mm Gypsum concrete topping on 15 mm OSB, 16 gauge joists



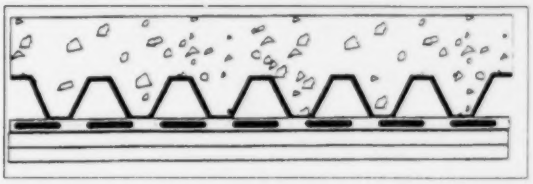
Subfloor	15 mm OSB
Joist Depth	203 mm
Joist Spacing	406 mm
Resilient Metal Channels	610 mm o.c.
Ceiling gypsum board	1 layer 15.9 mm

Cavity filling	Test ID	STC	Test ID	IIC
None	TLF-97-079a	55	IIF-97-039	24
152 mm glass fiber batts	TLF-97-081a	60	IIF-97-040	28



Slab Thickness	Test ID	STC	Test ID	IIC
145 mm	TLF-95-025a	53	IIF-95-004	27
95 mm	TLF-98-007a	47	IIF-95-003	20
Ribbed 75 - 150 mm	TLF-97-101a	51	IIF-97-045	21

Ribbed concrete slab with two layers of 12.7 mm gypsum board suspended from Resilient metal channels spaced 406 mm o.c.



Thickness	Test ID	STC	Test ID	IIC
Ribbed 75 - 150 mm	TLF-97-109a	57	IIF-97-049	36

Table 20 Ceiling Layers Only

Joist Depth	235 mm, solid wood
Joist Spacing	406 mm o.c.
Ceiling support	Resilient metal channels

Ceiling	Test ID	STC
1 sheet of 15.9 mm gypsum board	TLF-95-103a	29
2 sheets of 15.9 mm gypsum board	TLF-95-105a	35
1 sheet of 12.7 mm gypsum board	TLF-95-119a	29
2 sheets of 12.7 mm gypsum board	TLF-95-117a	33
1 sheet of light[1] 12.7 mm gypsum board	TLF-96-183a	27
2 sheets of light[1] 12.7 mm gypsum board	TLF-96-185a	32

[1] 7.4 kg/m^2 (1.5 lb/sq. ft.)

Solid 38 x 235 mm wood joists, 406 mm o.c.

Subfloor	Test ID	STC	Test ID	IIC
15 mm OSB[1]	TLF-95-101a	24	IIF-95-038	20
16 mm plywood	TLF-96-137a	22	IIF-96-060	18
2 sheets of 16 mm plywood	TLF-96-141a	26	IIF-96-062	22
13 mm plywood	TLF-96-145a	22	IIF-96-064	20
2 sheets of 13 mm plywood	TLF-96-149a	26	IIF-96-066	22
25 mm plywood	TLF-96-067a	22	IIF-96-021	14
35 mm normal weight concrete on 15 mm OSB	TLF-96-163a	41	IIF-96-072	15

[1] Caulking and taping the joints between the sheets of OSB had no effect on the sound insulation.

Solid 38 x 235 mm wood joists, 610 mm o.c.

Subfloor	Test ID	STC	Test ID	IIC
15 mm OSB	TLF-96-037a	25	IIF-96-010	19
19 mm OSB	TLF-96-041a	24	IIF-96-012	18

Wood I-joists, 457 mm deep, 406 mm o.c.

Subfloor	Test ID	STC	Test ID	IIC
15 mm OSB	TLF-96-081a	25	IIF-96-034	20
15 mm OSB	TLF-96-097a	25	IIF-96-042	21

Wood I-joists, 241 mm deep, 406 mm o.c.

Subfloor	Test ID	STC	Test ID	IIC
15 mm OSB	TLF-97-009a	24	97-005	18

CMHC Project Manager: Jacques Rousseau

Research Consultants: A.C.C. Warnock and J.A. Birta, National Research Council Canada

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